

# Innovation Management Processes for Academic Research

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**Abstract** — Academic research is promoting the free mind of the genius. The intention is to discover ground breaking findings in very early phases of the innovation process. The researchers consider their creativity to be dependent on freedom and openness. Nevertheless, today's scientific landscape is a bit different from this. Research institutions are large and many of them conduct project business. Research projects need to be planned in a professional way, research outcomes need to be achieved. A more or less professional innovation process has to guarantee a constant flow of projects and results. This is not only mandatory to finance the work of the research institution, but also due to the expectations of the society towards science. The challenge is to use professional innovation processes without destroying creativity and freedom. Ideas need to have a chance to result into a research project and a respective innovative finding. Scientists need to be protected from too much administration and restrictions. Therefore, innovation processes for academic research need to be lean, simple, efficient and effective. This paper presents ideas for such processes and tools. The focus is the early phase of transferring an innovative idea into a funding project. Results and experiences from the application in a research group focusing on applied engineering sciences are evaluated.

**Keywords**—*R&D Projects, Innovation Management, Academic Research, Scorecard, Trend Spotting*

## I. INTRODUCTION

Academic research is expected to create a constant flow of innovations and research results to serve the public needs of the financing society. There is lots of debate about how much bureaucratization and formalism this expectation justifies and how much academic freedom is still possible [2][8][10]. Nevertheless, academic researchers have to cope with the situation. There is a demand for a professional management system for academic research. This system has to be lean and efficient to prevent researchers from being buried in administration work, but it has to be effective in yielding a sufficient flow of innovations and results, too. Today, academic research institutions are evaluated according to these results and their funding is strongly dependent on

this. In addition, they have an intrinsic motivation to be excellent in research because this important for their reputation.

These constraints are the reason to strive for a professionalization of research management [12]. An important step in academic research is the acquisition of funding for a research project or the publication of a new finding. These two “results” are to some extent the “products” of the research industry. Therefore, the focus of this contribution is the innovation process needed to come from a promising idea to a funded project (or to a publication).

## II. ACADEMIC RESEARCH INSTITUTIONS

### A. Academic Research Platform

The innovation process described in the following chapter was applied to the research management of the academic research platform “PIMES – Process Improvement for Mechatronic and Embedded Systems” at Dortmund University of Applied Sciences and Arts, Germany. The focus of this research platform is to transfer scientific findings into industrial application by adapting and refining the scientific methodology and by testing and evaluating it in real world scenarios. This requires a strong collaboration with industry partners.

The research platform is focusing on engineering. It is run by 7 professors and employs 15+ scientific staff members. Approximately 15+ projects with funding volumes between 10.000 – 300.000 EUR are executed in parallel. The research platform serves as an example for the case study evaluation.

### B. Main Characteristics

The main characteristics of the research management for this research platform are quite typical for academic research:

The researchers have a strong link into their scientific community and they are observing the relevant trends in their field of knowledge. From reading, discussing and reasoning about new trends, ideas for further research are generated.

To investigate such an idea, knowledge has to be acquired and competencies have to be developed. Research in a specific area has to be based on a strong scientific competence in this area.

Usually, partners are needed for cooperation. A project needs scientists as staff members. A consortium or a team has to be built and the researcher has to motivate the consortium to work on the topic.

To run a project on the research topic, funding has to be acquired. Academic research is at least partially dependent on public funding. Therefore, a funding application has to be written and to be addressed to the respective funding organizations. Since public funding is usually bound to certain research and innovation initiatives, it is necessary to meet the scope and requirements of a respective research program.

From this brief summary of a typical way from an innovative idea to a research project the main inputs for a respective process can be derived. These inputs are the relevant scientific trends, the competencies and skills of the researchers, a consortium and a successful funding application within the scope of an open call for project proposals.

### III. INNOVATION PROCESS AND TOOLS

The following steps show the way from a promising innovative idea to the start of a research project. In academia, this starting point of a project is usually a funding decision or a grant.

#### A. Idea2Project Process

The idea2project process has the target to generate ideas from the analysis of trends and to refine and elaborate these ideas towards a research project.



Fig. 1: Simple Idea2Project Process

The main tool for trend analysis is a Trend Radar [4]. If a trend becomes sufficiently relevant and mature for the academic research team, ideas for project proposals are generated. New project proposals (or project ideas) are fed into an innovation funnel [7]. After passing the innovation funnel, a project proposal is sufficiently elaborated and has received a funding. The project can be started and enters the project pipeline of the research team/platform. The whole process is aligned with the strategic goals of the research team (or the university) by applying an adapted balanced scorecard [5].

#### B. Trend Radar

The trend radar or innovation radar is a tool that helps to define which areas have to be observed and at which stage a new trend or topic is close enough to the core of

the research focus of the team (or to the middle of the radar screen) to be considered for a project proposal.

To set up the trend radar, the research team defines the relevant areas (e.g. Area 1: energy) it wants to observe. This can be derived from national technology roadmaps, the scientific profile of the research institution or just from the scope of the funding programs the team wants to target. If an interesting trend in one of the defined areas emerges, a respective dot (e.g. “1”) on the radar screen is created outside of the outer ring. To move the dot closer to the middle, it has to pass a decision gate (e.g. to pass from ring A to ring B). At a decision gate, the trend is evaluated according to defined criteria (e.g. “is the trend mature enough for applied sciences?”, “does the trend allow synergies with ongoing research projects?”). This evaluation can be done on a regular basis in team meetings. If a trend reaches the middle of the radar, it is within the main scope of the research team. For such trends, project ideas may be created and evaluated.

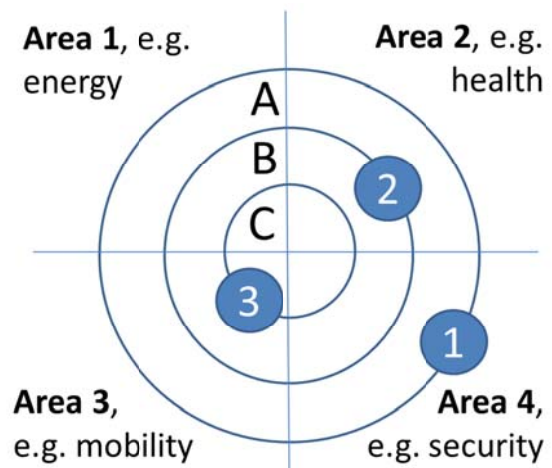


Fig. 2: Trend Radar/Innovation Radar

#### C. Innovation Funnel

If a project idea fits to the scope of the research platform, the further elaboration is managed with an innovation funnel and a respective stage system.

Innovation funnels are widely used and adopted in innovation management, but their use can be counterproductive if done wrongly [9]. It is important to set the right scope for the use: The main goal of the innovation funnel is not to reduce the number of the ideas or to prevent ideas or project proposals to enter from outside. The main goal is to guide the researcher through the elaboration process and to provide milestones for this process [7]. Of course, new project proposals can enter the innovation funnel at any stage and therefore, the number of project proposals is not necessarily reduced from one stage to the other. Nevertheless, a structured process is provided. This is the basis for controlling and managing the idea2project process.

The main stages of the funnel are as follows: If an idea enters the funnel, a team with partners or a consortium has

to be established. Resources need to be assigned and competence has to be built up. A project description and a funding application need to be formulated. Funding has to be secured. After passing these stages successfully, the project can be started.

In the example case, colors are assigned to the projects in the funnel (e.g. “1” is green, “2” is yellow and “6” is red in Fig. 3) to show the current status. Green projects are on track, elaboration is ongoing but in time without major problems. Yellow projects are still in the funnel, but have some more or less severe issues or may be delayed. Red project proposals will not be elaborated any further and drop out of the funnel. With the graphical representation and the use of colors, the researchers can easily understand the loading and balancing within the funnel. If a stage shows too few project proposals or many red ones, the research team may run out of projects after some time. Mitigation measures have to be taken. In addition to the usage of colors, project importance or project size can be visualized by using a different size for the bubbles.

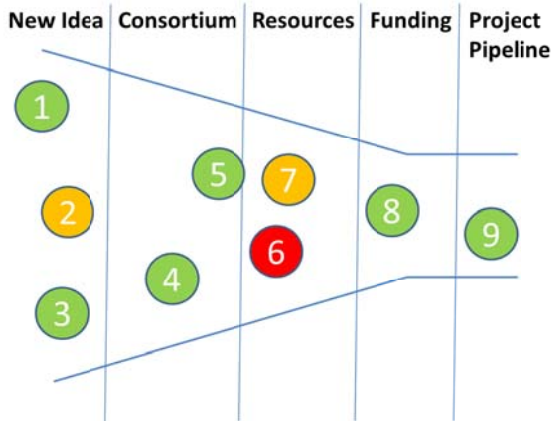


Fig. 3: Innovation funnel

As a basis for the graphical representation, an innovation sheet can be used to give a textual description of the information gathered in the stages of the project proposal elaboration.

#### D. Balanced Scorecard

The innovation process has to be aligned with the strategic goals of the research team (or research platform). A typical tool for strategy development, strategy description and strategy controlling is the balanced scorecard [5]. The intention of the scorecard is to show the strategic levers and the influence of certain measures and results on these levers. Therefore, the main benefit of a balanced scorecard is strategy communication and clarification. Different dimensions are used to create a balanced view. For the example case, the dimensions are adapted to academic research. Strategic elements for this scorecard are the sectors “Applied/Industrial Research”, “Academic Research”, “Teaching” and “Reputation”. The strategic vision of the research platform (e.g. “we want to

establish a competent research institution for mechatronics and embedded systems”) is divided into goals within these four sectors (e.g. “we want to be acknowledged by the research community as an important partner in questions regarding technical process improvement” for the dimension “Academic Research”). The views or perspectives of the scorecard are “Learning & Growth”, “Customers/Partners”, “Internal Processes” and “Finance”. An example for a strategic lever within the sector “Teaching” and the perspective/view “Learning & Growth” is the goal “Conduct cooperative PhDs with Universities”. German Universities of Applied Sciences do not grant PhDs. Nevertheless, PhD students are very important for research. They guarantee a sustainable development of scientific competence areas. Therefore, the PIMES research platform defines annual quantitative targets for the number of PhD students. The scorecard for the example case contains around 15 measures/levers with respective quantitative goals and key performance indicators.

#### E. Meetings and Communication

The tools (trend radar, innovation funnel/innovation sheet, balanced scorecard) are used to visualize and document the process of moving from an idea to a project. Regular monthly meetings of the whole team are done to discuss the status of the trend radar and the innovation funnel and to take corrective actions. The researchers update the data in the innovation sheet if a project proposal was elaborated further. Information in the innovation sheet is accumulated and analyzed, reports are derived. Apart from the regular monthly meeting schedule, two strategic workshops per year are conducted. During these workshops, the balanced scorecard is updated or adapted and the scope of the trend radar is discussed. The tools help to structure the meetings and to give an easy and comprehensive overview to all team members.

#### F. Confluence

The usage of the tools is supported by an IT system, the collaboration platform Confluence from Atlassian. The Confluence workspace of the research team contains the innovation sheet. Email notifications are generated if a team member updates the innovation sheet. The creation of the graphical representations and the report generation are partly automated. Key performance indicators for the balanced scorecard are stored and published within Confluence, too. They are part of the regular reporting towards the university board.

It is important to have a staff member who is maintaining the content and who is supporting and training the researchers in using the tools. The role is quite similar to a technology steward [14].

## IV. EVALUATION IN A CASE STUDY

The innovation management process idea2project was used within the research platform described in II.A for

approximately 3 years. There was a learning curve of about 1.5 years until the researchers really used the innovation sheet. Today the innovation sheet contains around 20 project proposals in all stages. Around 15 projects are in the project execution pipeline. Calls for project proposals are regularly reviewed and project proposals are generated according to the ideas. The graphical representation of the innovation funnel is used to keep an overview while discussing the innovation sheet during the monthly meetings.

The use of the trend radar is less established. The definition of the trends for observation is working quite well. It is fed by learning from previous projects, discussions with colleagues and industry partners and from analyzing the relevant technology roadmaps. Nevertheless, the decision if a trend moves to the middle of the radar is pretty much dependent on the expected benefit from the respective project idea in mind. Therefore, choosing trends is not fully driven by a real demand and a real match with the scope of the research platform but sometimes driven by opportunistic reasons.

The balanced scorecard is perceived as a valid instrument to keep all the goals of the research platform in mind and to understand the connection and causality of the goals. Furthermore, it is a very good tool for reporting key performance indicators. These key performance indicators are very useful to justify the work of the research platform in discussions with all the different stakeholders inside and outside of the university. Furthermore, it helps in evaluations and reviews of the work of the research platform and it can be used for target setting.

Overall, the process and the tools helped to structure an important part of the work of the research platform and to make academic research more professional. According to the researcher's individual perception, the results of the research platform became better in terms of quality and quantity, too. Nevertheless, this perception is not yet proven by comparison with research teams who do not use such processes and tools. An important comment from the researchers after a number of workshops is the finding that the tools helped to form a consensus about the research areas and the future direction of the research team. Furthermore, it helped to understand which parts each researcher can contribute to the goals.

## V. CONCLUSION

By introducing a process and tools for the core business of an academic research platform – the generation of project proposals and the acquisition of funding – it is shown, that this highly creative and intuitive work can be supported and structured. The tools

help to keep an overview about what future projects are in the funnel and what can be expected to be put into the project execution pipeline. The connection between trend radar and innovation funnel is straightforward. The measurement of the process performance and the alignment with the strategy by using a balanced scorecard adds the means to come to a comprehensive framework for managing academic research.

Further research is aiming to quantify the effects of the measures. This can be done by comparison with similar research platforms that do not use these tools and processes. Nevertheless, getting such data will be tough since the performance of research platforms is difficult to measure and even more difficult to compare. Furthermore, research platforms are not really keen on serving as a bad example in a benchmarking.

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